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Virginia Department of Game and Inland Fisheries and *WildlifeMapping*

The Virginia Department of Game and Inland Fisheries (DGIF) is the primary wildlife and freshwater fish management agency in the Commonwealth, with full law enforcement and regulatory authority to manage and protect those natural resources. Since 1916 the Virginia Department of Game and Inland Fisheries has been working for the people of Virginia to provide the highest quality wildlife management. The Agency's mission is to:

•Manage Virginia's wildlife populations to maintain optimum populations of all species

•Provide recreational opportunities for all to enjoy

•Promote safety for persons and property

•Provide educational outreach programs and materials that foster an awareness of and appreciation for Virginia's fish and wildlife resources, their habitats, and hunting, fishing, and boating opportunities.

The Department has traditionally been supported by hunting and fishing license fees, watercraft sales taxes, boat titling and registration fees, federal programs in which tax dollars spent on hunting and fishing equipment are returned to the states, and miscellaneous other monies such as the voluntary Non-game tax check-off. Since July 1, 2000, DGIF has received additional funding in the form of an appropriation based on two percent of the sales tax on outdoor supplies and equipment sold in Virginia, up to a cap of $13 million annually. The figure for sales is based on the most recent National Survey of Fishing, Hunting and Wildlife-Associated Recreation, which is published every five years.

To help manage Virginia's wildlife resources, the Department formally established a comprehensive computerized data system in 1981 as a cooperative research project with Virginia Tech. The first database, Biota of Virginia (BOVA), was implemented in 1984. Since then, the Department has compiled a variety of information in many different databases. The Fish and Wildlife Information Services Section is an outgrowth of these earlier efforts and now manages the ***WildlifeMapping*** Program's database.

WildlifeMapping Program Objectives

1. Provide distributional data on the wildlife species of Virginia.

2. Promote public involvement in the management of Virginia's wildlife resources.

3. Educate the public about the wildlife resources of the Commonwealth.

4. Complement survey, monitoring and research efforts in the Commonwealth.

WildlifeMapping
Volunteer Wildlife Monitoring: Learning and Working Together

WildlifeMapping is a hands-on volunteer wildlife-monitoring program that enables volunteers to contribute their wildlife observations to the state's biological database while promoting stewardship of our fish and wildlife resources. Virginia has one of the highest diversities of birds in the eastern United States, with nearly 400 resident and migratory bird species seen annually by birders from around the country and world. The state also boasts one of the highest diversities of all wildlife in the eastern United States, with over 2,200 species of fish, reptiles, amphibians, mussels, crayfish, birds, mammals, butterflies, and dragonflies already documented.

Long-term monitoring projects for any species are expensive and therefore increasingly rare. Understandably, such monitoring of even a fraction of our over 2,200 species is beyond the capacity of DGIF's wildlife biologists. However, ordinary citizens make wildlife observations every day. Many can identify the birds in their neighborhoods and children and adults alike often know where to find snakes and frogs. Children's unlimited curiosity and energy can be focused into educational and fun environmental projects. Surveys show that interest in wildlife and wildlife viewing is widespread and growing. This is further reflected in the large number of existing conservation groups, ranging from small grass-roots initiatives to international organizations. The public has a wealth of knowledge, wants to make a difference in the world, and is willing to assist natural resource professionals and land managers. Many professionals and managers have been reluctant to accept the public's assistance, but now that attitude is changing.

Virginia's resource agencies are charged by citizens of the state with managing our natural resources in a sustainable manner. These agencies can meet this objective through regulation and education, but regulation alone is insufficient. Training and education can help fulfill agency objectives by enabling citizen participation. ***WildlifeMapping*** is a key to fulfilling DGIF's overall mission. This program assists biologists with data collection and species distribution information while also meeting formal education plans set out by the Commonwealth in the Virginia Standards of Learning.

WildlifeMapping continues to grow and evolve. Our Data Entry program now allows wildlifemappers to download species distribution maps based on their own observational data or that of the entire ***WildlifeMapping*** database. Additional changes and improvements to the Data Entry program will better enable individuals, schools and communities the opportunity to provide and use data about wildlife species in their community as well as across the Commonwealth.

In a broader perspective, ***WildlifeMapping*** connects citizens to the environment that sustains them and all life, and encourages them to think about the relationships between human and natural systems. In this light, the environmental education component of the program does not

exclude cultural and economic values that affect the environment.

Program Participation

This program has been designed to serve three types of ***WildlifeMappers***:

- individuals,
- schools,
- community organizations (civic groups, businesses, conservation groups, scouts).

Individuals can provide much needed data by recording wildlife observations around their home, place of business, or wherever they have an opportunity to observe Virginia wildlife. School participation can fulfill two important goals: wildlife monitoring and environmental education. Communities may wish to inventory their wildlife species and use the information as an important component of both short and long-term land-use planning.

How the Program Developed

As demands on our natural resources increase, proper land management and land use planning will be critical for the maintenance of quality habitat for fish and wildlife populations and other natural resources. Unfortunately, species and the habitats that support them are disappearing at an alarming rate. Within the United States alone, 1,087 species of plants and animals have been listed as threatened or endangered. In Virginia, the DGIF Wildlife Action Plan has identified 925 “at risk” species, including 93 Tier I species that are in critical conservation need. As a result, "biodiversity" has become a familiar term and an important issue. How can we ensure adequate protection of animals and plant species and the habitats on which they depend?

Past efforts to preserve biodiversity have been reactive and have focused on rescuing species that teeter on the brink of extinction. This strategy is difficult, expensive and inefficient, and has been unsuccessful in slowing the rate of extinction. Additionally, limited conservation dollars cannot keep up with the recovery efforts for species currently listed as threatened or endangered. A proactive approach is needed to identify and protect geographic areas (habitats) that are critical to individual species or groups of species before their existence is threatened.

The National Gap Analysis Program is applying this approach throughout the United States using Geographic Information Systems (GIS). Gap Analysis focuses on maintaining populations of native species in their natural habitats. The analysis involves the use of satellite imagery to create a current land cover map for each state, which is then used in combination with species distribution data and public land ownership data. This combination of information is used to identify unprotected areas of high species diversity. The Conservation Management Institute at Virginia Tech and the Virginia Department of Game and Inland Fisheries are coordinating the Virginia Gap Analysis Program.

The Gap Analysis Program (GAP) works on a geographically large or **coarse scale**, analyzing

ecoregions within a state, the state itself, ecoregions that span multiple states, and the entire nation. County, city and other large-scale land managers usually need information for their land planning decisions on a **finer scale** than what is available from GAP. Thanks to an innovative program first developed by the Washington State Gap Analysis Program (WAGAP), information at this scale is now available in a number of states.

WAGAP developed a program to train the public on the products and uses of their datasets by asking the public to become involved with collecting data on wildlife at the local level. Audubon members and retired natural resource professionals were the first volunteers. A pilot project between WAGAP and the Washington Department of Fish and Wildlife (WDFW) began with 23 teachers in September 1993 and grew to 500 individuals and groups in 1996. The outreach program, now called *NatureMapping*, involves citizens, community groups, schools and city, county and state organizations. These individuals, groups and organizations all collect data on wildlife that is then available to everyone. Using the *NatureMapping* program as a guide, Virginia implemented its ***WildlifeMapping*** program in 1997.

Materials

The basic materials you need to participate in ***WildlifeMapping*** are:

1. Access to maps or a GPS receiver
2. Field guides
3. Binoculars (a camera is also useful)
4. Field notebooks and data collection forms

Maps and GPS Receivers

WildlifeMapping requires you to report the geographic location **(latitude and longitude)** of your wildlife observations. If you have access to the Internet, you can find all appropriate maps for your observation locations online (details in "Mapping" section). If not, or if you prefer to work off of maps in hand, there are a number of options available to you:

1. *Topographic maps* (often referred to as topo maps)
    a. 1:24,000 (also called a 7.5 minute quad)
    b. 1:100,000 (pronounced "one to one hundred thousand" or "1 to 100 K")

There are approximately 840 7.5 minute topo maps which cover the entire state of Virginia. Each map has a name and covers 7.5 minutes of latitude and 7.5 minutes of longitude. Virginia topographic maps may be purchased through the Virginia Department of Mines, Minerals and Energy (DMME): https://www.dmme.virginia.gov/commerce/

Each map is $6.00 plus sales tax and a shipping and handling charge.
Maps are also available from the United States Geological Survey by calling:

1-888-ASK-USGS (1-888-275-8747) or by visiting their website: http://store.usgs.gov/

2. *Gazetteers* – While determining longitude on topographic maps requires some calculations, one can read latitude and longitude directly from gazetteers, such as the DeLorme Atlas and Gazetteer for Virginia (they are available for all 50 states). Latitude and Longitude readings are given along the page margins with hatch marks indicating one minute increments.

3. *GPS receivers* – The Global Positioning System is a satellite-based navigation system that allows owners of a GPS receiver to determine their exact latitude and longitude anywhere with clear access to the sky. Today's better receivers can provide accuracy to +/- 3 meters or less.

Field Guides

Field guides are extremely helpful for wildlife and plant identification. There are field guides for virtually every taxonomic group, as well as for animal signs, such as tracks, scat, and remains. For students, the school library should have a basic set available for their use. However, you do not have to purchase or have access to all of them to participate in ***WildlifeMapping***.

There are also a number of references or field guides specifically about Virginia that are available. See Appendix 4 for a list of Virginia-specific field guides. There are many excellent field guides for North America and the eastern United States that are not included in this list.

Binoculars and Cameras

Binoculars are extremely useful. A good pair of 7x35 or 8x42 binoculars can be purchased at a reasonable price. If you are interested in observing butterflies, dragonflies or other insects, you will want to be sure to ask if your selection has a "close focus" feature. Such binoculars will allow you to focus on objects at a distance as close as 6 feet. There are 3-power binoculars available for younger children.

Cameras, especially digital, can be used to take pictures of unidentified species that can then be submitted to experts for positive identification. Cameras are also very useful for long-term projects. Pictures of habitat before, during, and at regular intervals after a restoration project, are valuable for project assessment. Documenting the primary and secondary habitats can also be accomplished through photography.

Field Notebooks and the Data Collection Form

Although ***WildlifeMapping*** participants watching wildlife in their own backyard, or on a field trip, need only to fill out the Data Collection Form, a field notebook or journal is a great resource and tool for recalling observations. A sketch of the field site (or a photograph) is a handy way to remember your visit, and a sketch (verbal or drawn) of an animal observed in the field may greatly increase the chances of identifying an unknown species. At minimum, your field notes

should include a description of the organism's size, coloration, other distinguishing features, its behavior, and the habitat in which it was found. Data collected in field notebooks can also be transferred to the ***WildlifeMapping*** Data Collection Form or directly into the online database.

Knowing how to record detailed information is an important component of any field study and the scientific process in general. Training students to take good field notes should be emphasized when teaching ***WildlifeMapping*** as a part of a class curriculum. Others who will want to develop good field note-taking ability include those working on long-term monitoring or habitat restoration projects, such as Master Naturalist volunteers,

Mapping

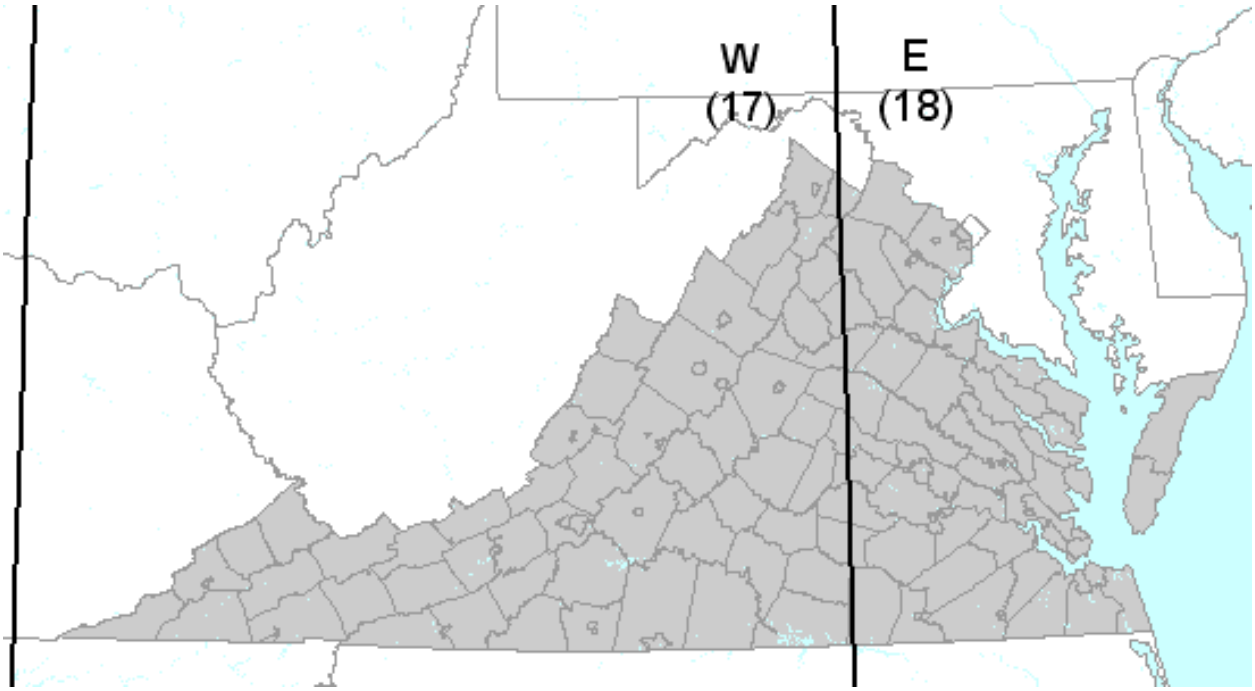
Knowing your location is just as important as identifying the wildlife.

Nowadays, most everyone is familiar with the universal method of describing geographic location, **latitude and longitude**, also known as a site's **coordinates**. Latitude lines, called parallels, run east to west. Longitude lines, called meridians, run north to south. Latitude and longitude are read in degrees (°), minutes ('), and seconds ("), with **latitude always preceding longitude**, e.g. 37°40'30"N; 81º23'06"W. (Since we are in the Northern Hemisphere, and west of the Prime Meridian in Greenwich, England, all latitudes are reported with an N following the readout, and a W follows the readout for longitude. Another way of reporting the same information is in **decimal degrees**, where the minutes and seconds are reported as a fraction of a degree. In the above example, the latitude and longitude would be, 37.675000ºN; 81.385000ºW.

The ***WildlifeMapping*** database will ask you to provide the coordinates for each of your observation sites under the **"Add a Site"** option when you first login (you must complete this step before you can enter any wildlife observations for a given site). The program provides you with 5 different format options with which to report your coordinates. If you choose to report it in degrees, minutes, and seconds, note that you have three options. Sticking with our previous example, the three format options would look like this: Option 1) 37,40,30 81,23,06; Option 2) 37,40,30 -81,23,06; Option 3) 374030 812306. **Important: regardless of which option you choose be careful not to insert any spaces between any of the numbers or commas for latitude or longitude. Use only one space to separate the last numeral of latitude from the first numeral of longitude.** If you choose, you can also report your coordinates using either degrees, decimal minutes or decimal degrees. In the former, only the seconds are reported as a fraction of minute. Again for our example, degrees, decimal minutes would be written as: 37,40.5000 81,23.1000. The last option is simply decimal degrees (as described above) and our example would be reported as 37.675000 81.385000. Note again that in each of the above formats, the only space used occurs between latitude and longitude.

In the "Add a Site" section, you will also be asked to report your Coordinate Source – either "Map" or "GPS Receiver". If your coordinates were determined with the use of a GPS Receiver, use **must** also indicate which UTM Zone your site was in. Virginia is divided between UTM

Zone 17 (the western part of the state) and UTM Zone 18 (the eastern portion). Consult this map to determine the line of demarcation between the two. You can also go to an interactive web site: http://projects.cares.missouri.edu/snmp/download/virginia.html that will indicate which zone you are in as you move the cursor over the map.



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DeLorme Gazetteer

If you choose to use the DeLorme *Virginia Atlas & Gazetteer*, you will be asked to report coordinates of your observation sites to the nearest 30 seconds (midway between two hatch marks), using a straight edge to line up you site with the minute hatch marks along the page margins.

Internet – Interactive Maps

If you don't own a GPS receiver, coordinates can most accurately be determined from any number of websites, such as *Google Earth*, or the DGIF website: **(www.dgif.virginia.gov).**

Click on '**Wildlife Information**' on the side menu bar, then click '**Virginia Fish and Wildlife Information Service"**. Next, click the '**Geographic Search**' button. You will then have the option to do a search by "**By Map**", "**By Coordinates**" or "**By Place Name**". Follow instructions to obtain a site's "lat/long" which will appear at the upper left of your screen.

Selecting Sites and Habitat Coding

Study Sites

A **study site** is any location that a ***WildlifeMapper*** uses to observe and record wildlife observations. Examples of study sites would be an individual's back yard, a local park, or the nearby school grounds. Remember that before you can submit your observations, you will need to select the "Add a Site" option once you login to the WildlifeMapping online site. To add a new site, you first are asked to assign a unique name to that location, such as "Mae Smith's Backyard", "Streamside", "Pond at Huntley Meadows", or "Buffalo Creek Nature Trail", or if you prefer simplicity; Tom's Site 1, Site 2, Site 3, etc. These names make it easy for you to identify which site you choosing to report your observations for each month. The number of sites at which you make wildlife observations is up to you! You may only choose to observe and report on the wildlife you see at one site, or you may have as many sites as the number of unique places you observe wildlife across the commonwealth. The other required information that you will need to provide are the county in which the site is located, the site's coordinates and the coordinate source (see **Mapping**, page 7). Once finished, simply hit the "Submit your Site" button to record that information.

Habitat Coding

For this section, please refer to the Land Use/Land Cover Definitions beginning on Page 1 in the Coding Manual (or the abbreviated version on page 12 of this manual).

Different species of wildlife make use of different habitats. Some species may be restricted to a single habitat (brook trout are only found in streams/rivers) while others may make use of multiple habitats, either daily or seasonally. American crows, for example, can be observed in almost any terrestrial habitat, from forests and farm fields to suburban backyards.

WildlifeMappers record and report the habitat in which each species was observed by assigning it a specific habitat name associated with a nationally developed three digit habitat code. While habitats can vary in size from a small puddle to an entire city or expansive forest, habitat codes refer to the overall **primary** habitat of the area in which the species was observed. The primary or dominant habitat would be the predominant habitat of the observation area. Within this predominant habitat, there may be one or more micro- or **secondary** habitats. For example, at DGIF headquarters in Richmond there is a small stream behind our building. The primary habitat is moderately developed industrial/business, and as such would be coded 122.. The stream is the secondary habitat because it creates a microhabitat within the larger primary developed area. It is not mandatory to report the secondary habitat. The secondary habitat becomes important when a larger habitat has a distinct yet smaller habitat within it, such as the stream in our example or perhaps a farm pond in a large pasture.

In some circumstances, determining the dominant habitat may be difficult. It may be useful to

consider how you would categorize your site if you were afforded a bird's-eye view of the area. While your backyard might be a wildlife haven, the view from a hundred feet up would reveal that it is the only yard that offers food and cover within an otherwise moderately developed residential area. ***WildlifeMapping*** is primarily interested in the larger habitat framework.

Beginner Habitat Codes

Assigning habitat codes can be difficult for the new ***WildlifeMapper***. The following list is based on the most frequently reported habitat codes submitted by ***WildlifeMappers***. A condensed list of all the codes follows on the next page. The complete list of habitat Land Use/Land Cover codes, along with their definitions, can be found in your yellow Code Manual. Please note that all habitat codes are three digits and each digit is significant because it gives a finer degree of detail about the habitat. On the complete list of habitat codes you will note the use of "0" as an option for either the second or third number. **Only use "0" if you cannot decide among the other choices available at that level of habitat distinction.**

Developed Areas	
112	**Downtown City (tall buildings/skyscrapers)**
114	**Interstate/Road in a city**
134	**Rural Interstate or road**
121	**Moderately developed business or residential area**
131	**Lightly developed residential neighborhood**
135	**Schools, golf courses, mowed parks with trees/grass**
Unvegetated Area	
232	**Cliffs**
233	**Beach**
236	**Mudflat**
Agricultural Areas	
311	**Pasture**
312	**Crop Fields (soybeans, corn, etc.)**
313	**Orchard**
Unforested Areas	
412	**Unmowed meadow (wildflowers or not recently disturbed)**
415	**Unmowed pasture with cedars growing up**
416	**Recent clearcut area**
Forested Areas	
570	**Deciduous Forest (Trees that drop their leaves in winter)**
670	**Mixed Deciduous/Coniferous Forest**
711	**Planted young pine plantation**
770	**Coniferous Forest (Trees that bear cones, usually pines)**

Water

812	**Reservoir**
814	**Farm/small pond**
815	**Stream/river (fresh flowing water)**
820	**Open Saltwater**

Wetlands

920	**Vegetated freshwater marsh**
925	**Forested wetland**
930	**Riparian (edge of stream or river) area**
950	**Vegetated ocean beaches/behind dunes wetlands**

Land Use/Land Cover Habitat Types

1 Developed
- **0** All
- **1** Heavy > 60%
- **2** Moderate 30-60%
- **3** Light < 30%
  - **1** Residential
  - **2** Industrial/business
  - **3** Mining Operations
  - **4** Roads
  - **5** Grass/Shrub
  - **6** Urban Forests

2 Unvegetated
- **31** Rocks/Talus
- **32** Cliffs
- **33** Sand (beaches, dunes)
- **34** Bare Soil
- **35** Cave
- **36** Mudflats

3 Agriculture
- **00** All crop species
- **11** Developed/maintained pasture
- **12** Row crops
- **13** Orchards/Vineyards/Pine Plantations

4 Non-forested
- **0** Successional and climax vegetation
- **1** Recently disturbed/successional
- **2** Undisturbed/climax
  - **0** All structure classes
  - **1** Sparsely vegetated
  - **2** Grass/forbs
  - **3** Shrub savannah
  - **4** Shrubland
  - **5** Tree savannah
  - **6** Clearcut

5 Upland Forest: Deciduous*
6 Upland Forest: Mixed Deciduous/Coniferous*
7 Upland Forest: Coniferous*

(* The subcodes for these three classes are identical)

- **0** All structure classes
- **1** Saplings
- **2** Pole
- **3** Small Sawlogs
- **4** Large Sawlogs
- **5** Old Growth

Only use codes 1-5 for uniform stands such as plantations or commercial timberlands.

- **6** Young Forest
- **7** Intermediate Aged Forest
- **8** Mature to Over-mature
  - **0** Open and closed canopy
  - **1** Open 20-60% canopy closure
  - **2** Closed > 60% canopy closure

8 Open Water

- **00** All Open Water
- **10** Freshwater
- **11** Lakes
- **12** Reservoir
- **14** Pond
- **15** Fresh flowing water
- **17** Canals
- **20** Salt Water
- **30** Brackish water (partially salty)

9 Wetlands

- **0** All Wetland Types
- **1** Estuarine Marsh (saltwater)
- **2** Freshwater Marsh
- **3** Riparian (edges of rivers and streams)
- **4** Vernal Pools (dry up part of the year)
- **5** Ocean Beaches (vegetated)
- **6** Intermittent Streams
  - **0** All Wetland Types
  - **1** Submerged/floating plants
  - **2** Emergent herbs/shrubs
  - **3** Trees-deciduous
  - **4** Trees- coniferous
  - **5** Trees – mixed deciduous and coniferous

A Final Word on Habitat Codes

The important thing to remember is not to get stuck trying to figure out habitats or assigning the correct Habitat Codes, JUST BE CONSISTENT. If you code a habitat as 412 (Unmowed meadow), for example, then use code 412 every time you make observations in habitat that looks like this. ***WildlifeMapping*** is **most** concerned with the presence/absence of species at a given geographic location (latitude and longitude). Habitat coding, while important, is secondary to the accurate reporting of both the species observed and their geographic location.

Recording Observational Data

The easiest way to record your wildlife observations is to have a copy of the ***WildlifeMapping*** **Data Collection Form** with you when you are conducting your observations. (You may, of course, devise and use your own note-taking methodology, but be certain you record all the information necessary to allow you to enter that data online.) You will find instructions for this form, as well as the form itself, on the following two pages. Make multiple copies of the form so that you will always have one available for recording new data, and leave the one in your manual blank so that you can make additional copies in the future. Remember that you will be submitting a **summary** of your observations for each site for any given month. If you collect more than one set of observations for a given site during any month, many find it useful to use the Data Collection Form to create a **Monthly Summary**. You can then use this Monthly Summary to directly enter your data online. It is suggested you maintain these Monthly Summary sheets for future reference and as a back-up to the online database.

Let's look at how observations might be recorded at a single study site. The Smiths decide to record their wildlife observations at a nearby park on a weekly basis. They assign this site a **671 Habitat Code**. Had they chosen to do so, they might have assigned a **secondary habitat code of 922** to the small marshy wetland where they heard the spring peepers and green frogs. Here are their data for the first month:

Week 1	Week 2	Week 3	Week 4
2 Dark-eyed juncos	1 Dark-eyed junco	4 Blue jays	3 Blue jays
1 Blue jay	3 Blue jays	1 Ovenbird	2 Ovenbirds
1 Barred owl	2 Red-eyed vireos	1 Red-eyed vireo	1 Eastern towhee
4 Spring peepers	50+ Spring peepers	1 Green frog	3 Green frogs
			1 Black rat snake

The Smiths will need to summarize their data for the entire month before submitting it online. To do so, they need to list the greatest number of individuals of each species they observed at this one site during the month. Here's what their monthly summary should look like in terms of the numbers of individuals of each species they observed:

2 Dark-eyed juncos
4 Blue jays
2 Ovenbirds
1 Barred owl
2 Red-eyed vireos
1 Eastern towhee
50 Spring peepers (est)
3 Green frogs
1 Black rat snake

Remember, when summarizing your data for monthly submission, you will submit *the greatest number of individuals of each species observed during that month at any one time*. The figures you submit monthly are NOT species totals or averages. You may record your observational data at any time after your last period of observation at any site for a given month. **There is no deadline for submission**! Even if considerable time elapses, you may always submit data from previous months or years. Do not however, combine data from more than one month or more than one site.

Data Collection Form Instructions

Name: Name of the observer that has been registered after taking a ***WildlifeMapping*** workshop.

Description of Location: Try to describe the area based on the type of vegetation. For example, coniferous forest, low developed (lots of trees, lawns, parks, golf courses), medium developed (new housing developments, large apartment complexes, etc.), freshwater marsh surrounded by shrubs.

City/County: City (those recognized in online menu) or county where the observation occurred.

Date: The month and year (MM/YYYY).

Species: Try to identify the species. (Photographs are accepted, if you have questions on the identification.) Please do not omit the species if you are not sure. In such cases, put a "?" after the species name.

Source of Identification: How did you identify the animal? Did you see it, hear it, was it dead along the side of the road? Did you see scat, tracks?

Latitude/Longitude: This figure can be determined from your DeLorme Gazetteer, a topo map, GPS unit, or from any number of online sites, such as DGIF's: http://vafwis.org/wis/visitor/geographic.asp?sID=124780&ln=V&nav=geographic

How many did you find? Count the number of animals you see. If there are a lot, you can make an estimate. A quick way to estimate is to count 10 birds and estimate how many other sets of 10 birds you see. Remember, the identification of the animal is more important than the number of animals observed.

Habitat Code: Record the **Primary Habitat Code** for each of the sites for which you are submitting data. You need not record a **Secondary Habitat Code**, but are encouraged to do so if you observe animals utilizing unique micro-habitats within the primary habitat.

Online Data Submission

To submit your data online, go to the ***WildlifeMapping*** page on the DGIF website: http://www.dgif.virginia.gov/wildlifemapping/ Clicking on the "Online Data Entry" link will take you to the Login page where you will type in your email address (the same one you provided us at your workshop) and your password (which at the time of your workshop was your last name, first letter capitalized, e.g. Smith). If you are submitting data online for the first time, you might find it useful to review the instructions section - found by clicking on the help page link on login page.

When you are ready to submit your wildlife observations, you will select the "Enter Observations" option, which will bring up the "Data Entry- Step 1" form. You will first be asked to select the site name –the name you assigned to the location where you observed the species you now want to record (Review "Study Sites" on page 9 if needed). This box has a drop down feature, so clicking on the "down" symbol on the right, will list all of your named sites, in the order they were entered. Simply click on the name of the site you want to enter data for and it will automatically be entered into the box. The other required information on this page that you must enter are the reporting month and year and the Primary Habitat Classification and (optionally) Secondary Habitat Classification (see section to follow). Once you've selected the habitat classifications (again a drop-down menu in order of habitats codes), hit the "Continue/Next" button on the bottom of the page and you will be taken to the "Data Entry – Step 2" form. On this page, you will first select the taxonomic group of the species you wish to record (Amphibian, Bird, Mammal, etc.).

Once selected, the species list for that group will appear as an alphabetically-listed drop down menu to the right. Simply scroll down to select the species you wish to record. Other information you will enter on this form are the number of individuals (the maximum number of that species observed at any one time that month at that site), the type of observation (visual, heard, scat, track, etc.), and whether or not the number you entered was an estimate or not, and whether or not your observation was questionable. Report as "questionable" any sighting that you are not 100% certain, but at least 90-95% certain. If you are less certain than that, **do not** report that sighting. You may also include any comments (up to 250 characters) in the box provided. You have a number of options listed at the bottom of the form to continue adding species, review, reset, or cancel and return to main menu.

Wildlife Observation 101

The following are a few general pointers to keep in mind as you begin observing wildlife:

1. Identification of a species is more important than an accurate numbers count. Make use of field guides to determine what species are likely to occur in your area (consult range maps) as well as learn all you can about the various habitat preferences of common species. With that basic knowledge, you will find it easier to use the process of elimination in identification.

2. Many birds migrate through Virginia in spring and autumn. Over 50% of Virginia's bird species are migrants. Knowing which species are likely to be at your location at any given time of year will again assist you in proper identification.

3. Wildlife use different parts of their habitat at different times of the year. Different species are also active at different times of the day. Knowing what to look for and when will increase your chances of observing wildlife. Remember, many species of wildlife, such as frogs, bats, owls, whippoorwills, common nighthawks, opossums and raccoons, are more active from dusk to dawn and your chances of observing or hearing them will be greatly increased if you include evening observations.

4. Learn to estimate the size of an animal by relating it to known measurements. A great horned owl looks much like a screech-owl aside from their difference in size. Great horned owls are about as tall as an adult's forearm. A screech owl is about the size of an adult's hand.

5. Most reptiles and amphibians (herptiles/herps) can be found readily from spring through fall. Field guides are very helpful in their identification and DGIF has two excellent booklets available online (https://www3.dgif.virginia.gov/estore/products.asp?id=16) to assist you: *A Guide to the Snakes of Virginia* and *A Guide to the Frogs and Toads of Virginia*, which includes a CD with vocalizations of all 27 species found in Virginia. As toxins are readily transferred to amphibians because of their permeable skin, it is best to carry a pair of disposable gloves with you if you anticipate handling them. **Always** return any herptile you pick up for closer examination to the exact location at which you found it.
6. Reporting observations on mammals can be difficult. First, because many species of mammals are either nocturnal, small, and/or fossorial (live underground), they often go unseen. Knowing how to identify tracks and scat can therefore be extremely useful additions to your observational tool bag. Second, certain mammals (such as bats, mice, rats and shrews) are lumped into one generic name. For instance, there are 16 species of bats, 8 species of mice and 8 species of shrews in Virginia. A field guide can improve your identifications skills, but the Code Manual does give generic code numbers for bats, moles, mice, rats, and shrews. General codes are given for species such as bats (052001) because we don't expect you to get close enough to identify individual species. However, knowing

generally where bats occur can assist us with future research.

7. When faced with a "questionable" identification, it is always best to mark you observation as such-'questionable'. However, if you see a species that 'shouldn't be here', but you are certain of its identity-submit your observation! Remember, wildlife is not a static resource. As Virginia's wildlife responds to habitat modification and climate change, ranges and distributions will shift. Additionally, individuals can and do occur outside of their normal ranges. One observation may not be significant, but 10 or 20 will be. Scissor-tailed flycatchers, Mississippi kites, elk, and porcupine are just a few of the species which have recently been sighted in Virginia, and most were first reported by volunteer observers!

Do keep in mind that *WildlifeMapping* is more interested in the common species than in the 'odd' occurrences. State biologists actually have very little information about the distribution of many of our common species, and this is precisely where you, as a *WildlifeMapper*, can be of most assistance.

Binoculars and Optics

Finding the right binoculars for wildlife viewing requires you to become familiar with some basic numbers and terms. Let's first consider the two numbers which are used to categorize binoculars, such as 7x35 or 10x50. The first number gives you the magnification power of the lenses: the larger the number, the greater the magnification. 10X binoculars will make objects look much closer (larger) than 7X binoculars. However, bigger isn't always better. This is because the magnification power of binoculars is inversely proportional to its field of view. Field of view, usually inscribed on the binoculars below the other two numbers, is the width of area visible at 1000 yards, such as 412 feet at 1000 yards. Binoculars with higher magnification will have narrower (smaller) fields of view. A narrow field of view makes it much more difficult to locate the object you are looking for, and in addition, are harder to hold steady. Most wildlife observers prefer binoculars with 7-8X magnification, especially if their primary use is for bird watching.

The second number is a measure of the diameter of the objective lens (the **BIG** lenses in the front of the binoculars). The larger the lens diameter, the more light the binoculars will let in. This is advantageous if you want to distinguish details in low-light situations, something birders often encounter on early morning outings in heavily forested habitats. The down side is that the larger the diameter, the larger (and heavier) the binoculars are likely to be, and the harder they will be to keep steady during extended observation. Most birders tend to favor binoculars in the 7x35 to 8x42 range. Today's binoculars have improved markedly (lighter, better optics) compared to those rather large, heavy versions common a generation or two ago.

If you plan to spend significant time looking at butterflies, dragonflies, or other wildlife within 15 feet, you might want to purchase a pair of "close-focusing" binoculars. Close-focusing binoculars will provide you with a sharp image of subjects as little as 6 feet away. If you're

going to use binoculars primarily for birding or viewing more distant objects, the close-focus feature may not be as important a consideration.

Binoculars should be in proper alignment. The easiest way to test for alignment is to hold the binoculars away from your face and look through them at something with a straight horizontal edge. If the edges are level in both eyepieces, then the binoculars are in good alignment. If one edge is higher than the other, the binoculars need to be realigned. This isn't something you can do yourself; it must be done by a professional.

For people who wear glasses, remember to buy binoculars that have either rubber eyecups or extendable oculars (eyepieces). The eyecups should be folded down so you don't need to take your glasses off each time you use your binoculars. If you are far-sighted or near-sighted *and have no astigmatism*, your binoculars will compensate for not wearing your glasses, if you don't want to wear them.

To correctly focus binoculars:

1. Find a sign or detailed object about 30 feet away.

2. Notice that the binoculars pivot on a center hinge. Spread the eyepieces as far apart as possible and then bring them up to your eyes and bring them back together until the image you see in both eyepieces converges into one circle.

3. Turn the center focus wheel counter-clockwise to take the image completely out of focus. Most binoculars have a single ocular focus adjustment located on the right eyepiece; turn it as far as it will go clockwise. Bring the binoculars up to your eyes, then close your right eye or cover the right lens so you are only looking through the left eyepiece (reverse if the ocular focus is on the left eyepiece).

4. Bring the object you are looking at into sharp focus using only the center-focusing wheel of the binoculars.

5. Now close your left eye or cover the left objective so that you are only looking through the right eyepiece. Bring the object into sharp focus by slowly turning the right eyepiece ocular adjustment knob. Now look through the binoculars with both eyes. Your binoculars should now provide you with a clear view of any object you bring into focus.

6. Hint: Make a notation of the settings on the right eyepiece single ocular focus so that you can quickly return your binoculars to your particular focus if you loan them to someone else.

Note: To use binoculars correctly, always keep your eyes on the object you want to look at and bring the binoculars up to meet your eyes. If you look down at your binoculars, the object will be more difficult to find and will most likely have moved anyway.

More detailed instructions on this procedure and on binoculars can be found in the *National Audubon Society Birder's Handbook* by Stephen W. Kress, Ph.D.

Field Preparation

If you choose to undertake long-term monitoring of a particular site, there are a number of things that you can do beforehand to improve your experience. Obtain a recent topographic map of the area and use it to assist in a survey the area. Outline the major habitat types you are likely to encounter during your monitoring. Obtain information about the wildlife in the area. Resources to assist you in obtaining wildlife information include:

* Virginia Department of Game and Inland Fisheries online Fish & Wildlife Information Service, which provides species lists for each county as well as individual species accounts
* Literature available through the Virginia Department of Game and Inland Fisheries, Virginia Department of Forestry, Virginia Department of Conservation and Recreation, and the United States Fish and Wildlife Service
* Area-specific species lists - many groups create species lists for their areas, including city and state parks, zoos, and U.S. Fish & Wildlife National Wildlife refuges
* Field guides, especially those most specific to your region
* Local Audubon chapters
* Local libraries.

In field guides, mark sections you think you will need to reference the most, or mark the wildlife known to occur in Virginia or your region. This will be a big help when you are trying to quickly identify an animal in the field. You may also finding creating lists of which species are most likely found in specific habitats to be useful.

Search Tips

Remember that identifying field marks may be misleading when two species are similarly marked. For example, the "horns" of the great horned owl are also found on the eastern screech owl. The difference between the birds is size; a great horned owl is about the length of an adult's arm from the elbow to the fingertip, while the eastern screen owl is about the length of an adult's hand from wrist to fingertip. Also note that fledgling birds are just as large as their parents are when they leave the nest, but are often distinguished by their distinct juvenile plumage; they usually don’t look like miniature adults.

Migratory Animals

Many birds migrate within our state, as well as to, from and through our state. Over 50% of the bird species we see are migratory. Many species are characterized as neotropical migrants. These birds overwinter in Mexico, Central and South America; returning each spring to breed in the United States and Canada. Other species like snow geese and many birds of prey spend the

winter here. April through May and September through October are the months that many birds pass through our state to their breeding or wintering grounds. These are also the months that many year-round resident species migrate from one elevation to another (i.e. up and down mountains).

Looking at the Right Time to View Animals

Many animals use different types of habitats at different times of the year. They may also use different habitats depending on their age and sex. For example, tadpoles are confined to water, while adult amphibians may spend most of their time on land. Female ducks may use shrubs to hide their young, while males may not use shrubs at all.

Spring is the breeding season for many species. Throughout the year, adult bird activity is usually the highest at sunrise and at sunset. In spring, however, nestlings must be fed from sunrise to sunset, so adult activity remains high throughout the day. Regardless of what they eat as adults, approximately 95% of all bird species feed their young caterpillars and other insects. Since many insects require a certain amount of warmth before they become active, bird activity may be delayed on rainy or chilly days.

Don't forget that some animals, like rabbits and deer, exhibit peak activity at dawn and at dusk (referred to as **crepuscular** activity), while many others are nocturnal, being primarily active from dusk to dawn.

Reptiles and Amphibians (Herps)

Because reptiles and amphibians assume the temperature of their surroundings, most all hibernate or are otherwise inactive during the colder months of the year, although some amphibians begin breeding in late February or early March. Most herps can be found readily from mid-spring through mid-fall, with peak activity for most reptiles occurring during summer.

While it may be useful to handle herps for purposes of identification, specimens should always be released where they are found. Releasing captured animals into different habitats is likely to result in death or injury to the individual animal and may pose a risk to the community into which it was released. Additionally, such releases may alter the natural distribution patterns of species. Remember, one of ***WildlifeMapping's*** goals is to have participants associate species with habitats. One study even documented that one of the primary causes of the reduction of frogs in a popular wilderness area was due to families collecting tadpoles and taking them home.

Be careful when handling amphibians, their skin is highly permeable and therefore very susceptible to contact contaminants. If you must handle them, make sure your hands are wet and free of any insect repellent, sunscreen or other chemicals, or better yet, bring and use disposable gloves. It is best to put them in a baggie sufficiently filled with site-collected water if you plan to pass them around. With regard to reptiles (turtles, lizards and snakes)

it is important to remember that any species, venomous or not, may attempt to bite you if you try to pick it up. Because they have "dirty mouths", reptilian bites that break the skin can result in serious infection if the wound is not thoroughly and immediately cleansed.

Birds

Bird watching is an exciting and growing avocation. Next to gardening, it is the most popular recreational activity in the United States. With a decent pair of binoculars, anyone can learn to identify and appreciate the common species in their area. Identifying warblers and other small woodland species that move quickly and spend much of their time in the upper canopy is both more challenging and rewarding. Many birders rely not only on their keen eyes, but on their ability to identify birds by their songs. There are many good resources both on CD and on the Internet to help you learn bird songs. Mnemonics may help and there is a section in this manual to help you learn bird songs by mnemonics.

You can increase the wildlife diversity of your own backyard by providing habitat in the form of food, water and shelter. Native plants are at the base of all food webs and are the preferred sources of food for many species, especially birds. Remember, different species eat different foods, so be sure to include plants that provide nectar (for hummingbirds as well as butterflies and other pollinators), fruits and berries (especially important for fall migrants), and seeds (a mainstay for winter residents). Many butterflies require specific host plants that they feed on as caterpillars. Learning which plants attract which species of butterflies can be another interesting dimension of creating a wildlife-friendly backyard landscape. Water is a big attractant for birds and amphibians. Recirculating pumps create the sound of moving water - a real draw for many species. Bird boxes can be useful in attracting cavity-nesting species, such as wrens, bluebirds, woodpeckers and owls. Creating woodpiles or other appropriate hiding/resting sites for herps and small mammals will provide additional welcome shelter for the smaller critters.

Commercial birdseed and feeders can be very specific for particular species, so learn what types of feeders attract which species. *Remember when you feed birds you feed all the birds.* When you create a situation where many birds congregate in one area, like your feeder, hawks and falcons may also be attracted. Coopers hawks and sharp-shinned hawks are the two most likely visitors to grab birds from your feeder. It can be a great surprise when a blur passes your feeder, but it's also a real treat to see these hawks up close.

Mammals

Aside from rather ubiquitous squirrels, a mammal sighting during a field trip should be considered a bonus more than an expected occurrence. While most people are familiar with medium to large-sized mammals, such as raccoon, opossum, fox, beaver, and deer, most mammals are small and seldom seen. Because they are easy prey for a wide variety of predators, most small mammals (mice, voles, shrews, and moles) tend to be fossorial (underground) and/or nocturnal. Second, because we are unfamiliar with many of them, we often lump many species

under one name, such as “mouse”, “shrew” or “bat”. In fact, there are 15 species of “mice”, nine species of shrews and 16 species of bats in Virginia. Field guides will provide the habitat requirements, geographic location and physical features to identify these species if you happen to see one (most often dead). Bats are usually seen at dusk, flying over water, open fields, and high in the canopy of forests. Many people see bats, but mistake them for starlings or swallows.

General codes (found in Appendix 1), such as 052001 for bats or 052003 for mice should be used when the exact species cannot be identified.

Butterflies and Moths

These insects are easiest to observe if you have a garden (or know where one is) with flowering plants on which adults can nectar. Butterflies are more active in the late morning to afternoon after it warms up. They are also often found near small puddles or at the edges of streams where they extract minerals from damp ground. As mentioned earlier, most species of butterflies are host specific with regard to their larval food, so sites like a botanical garden or local nature center that have a wide variety of native flowering plants will most likely have a larger variety of butterflies.

Moths are usually more active at night, but not always. The hummingbird moth is active during the day (late afternoon to early evening) and is often confused with a small hummingbird. A good way to see a variety of moths is to hang a sheet out at night and shine a light on it. Moths are attracted to the light and will rest on the sheet. If you are really enthusiastic, using a black light will increase the diversity of species you attract. Remember, close-focus binoculars are handy for getting a closer look at butterflies and moths.

Dragonflies and Damselflies

Dragonflies and damselflies are usually associated with water. Many varieties, in a multitude of sizes and colors, are known to occur in Virginia. Both are easiest to observe and identify when they are resting on vegetation on warm, sunny days. You can distinguish between the two groups by observing their wing placement at rest. Damselflies rest with their wings pulled together over their bodies while a dragonfly’s wings are horizontal at rest. This is another group for which close-focus binoculars are a real plus.

Tips for Responsible Wildlife Viewing

Wildlife Watchers Creed
(Adopted by the National Partners in Watchable Wildlife)

We, as wildlife watchers, will put the needs and safety of wildlife first, conserve wildlife and habitats, and respect the rights of others. We will seek wildlife watching experiences that reward us with the gift of seeing animals behaving naturally in their own environments. Recognizing the importance of learning specific codes of ethics for observing birds, mammals, fish, reptiles, amphibians, and insects in the wild, we will adhere to these guiding principles:

1. **Observe animals from a safe distance for us and for them.**

- Use binoculars, spotting scopes and viewing blinds for a close view.
- Move slowly and quietly to increase your chances of seeing wildlife and minimize disturbance to wildlife.
- Most animals have a very acute sense of smell so avoid the use of scented lotions, perfumes or colognes.
- Avoid nests and dens. Leave baby birds and other young animals where you find them. Mom is usually close by even if you can't see her.
- Learn to recognize and respect wildlife alarm signals. When an animal changes behavior as a result of your presence, you are too close.
- Artificial calls and lures disrupt natural animal behavior and should be used only by professionals and then only sparingly.

2. **Allow wild animals to forage for their natural foods.**

- Put the safety and health of wildlife first by resisting that impulse to offer a handout. Animals can be harmed by human food and those that expect handouts from people can become quite aggressive.
- Reserve feeding of wildlife to backyard birds and squirrels.

3. **Film and photograph wildlife responsibly.**

- Use a telephoto lens from a viewing blind or a vehicle.
- Chasing, herding, flushing or making deliberate noise stresses wildlife.
- Leave plants, trees and other natural features as we found them.
- Encourage photo and film editors to adopt ethical standards that include lens size of published photos, depict wildlife as part of a natural environment, and identify photos of captured wildlife.

4. **Always be considerate.**

- Ask permission to watch or photograph wildlife on private land and observe all rules and regulations.
- Close gates and return property to the condition it was in when you arrived. 'Take only memories, leave only footprints'
- Wait your turn to view or photograph animals when sharing a viewing area.
- Leave pets at home or in the cars.
- Tread lightly, staying on trails and roads to minimize negative impacts on the environment.

5. **Be a responsible wildlife landlord**

- Keep feeders, nest structures and other artificial wildlife environments clean and disease free.
- If you are attracting wildlife to an area, ensure that they are not exposed to predation from cats and other domestic animals, or dangers posed by artificial hazards such as waste antifreeze or windows.
- Remember that when you feed wildlife, you feed ALL the wildlife in your area, not just the songbirds.

5. **Plan ahead, get involved, and be respectful**

- Consult your local wildlife agency for specific guidelines on ethical wildlife watching, filming and photography.
- Participate in wildlife and habitat conservation.
- Help others to become responsible wildlife watchers.
- Always research your wildlife watching trips ahead of time to get the most benefit from each opportunity.
- Resist the urge to disturb wildlife just to see it. Undue stress on animals can cause them to abandon nests and deplete fat reserves they need to survive.
- Keep a good distance between you and nests…you may be leading predators to dinner or scaring adults from their young.
- Move quietly and slowly to minimize your disturbance; If you notice wildlife noticing you…you are too close!
- Stay on trails and roads where available. New paths cause erosion and habitat destruction.

HAVE FUN!!!

Parts of this document were taken from:

Watchable Wildlife, Inc. *Wildlife Watcher's Code of Ethics* and the American Birding Association's *Principles of Birding Ethics*

Appendix I: Glossary

Amphibians – the class of cold-blooded animals such as frogs, toads, newts having gilled aquatic larvae and air-breathing adults.

Biodiversity – the variety of all organisms and their genetic makeup, including the communities and ecosystems in which they live (after Wilson, 1992)

Digitize – to put data into digital notation or place an exact geologic coordinate into a computer system

Endangered – official category of the U.S. Fish and Wildlife Service and the Virginia Department of Game and Inland Fisheries that places a species into a category of being threatened with extinction or extirpation either as a species or from Virginia. A species with so few surviving individuals that it could soon become extinct in all or most of its natural range.

Fauna – all the animals or animal life of specified region, period, or geological stratum.

Fledgling – a young bird that has recently acquired its flight feathers

Flora- all the plant life of a specified region, period, or special environment

Geographic Information System – a computer based technology that maps particular features using coordinates stored within a database

Global Positioning System – a navigational tool using a receiver to communicate with a network of satellites to determine (triangulate) a position

Habitat – the place or type of site where a plant or animal naturally or normally lives and grows. An environment defined by the vegetative and physical characteristics of the area, such as an oak-hickory forest or freshwater impoundment.

Herptiles (herps) –amphibians and reptiles; the general combination of the two groups

Inventory – an itemized list of animals or plants associated with an area or region

Land cover – the vegetation classification for a particular area or region

Land use – a particular category for utilization of a particular area or region

Latitude – angular distance (degrees) north or south from the earth's equator measured through 90 degrees. Lines of latitude area called parallels.

Longitude – the arc on the earth measured in degrees east or west of the prime meridian. Lines of longitude are called meridians.

Meridian – the representation of a great circle or half circle numbered for longitude on a map or globe that passes through the poles

Migratory – to pass, usually periodically, from one region or climate to another for feeding or breeding

Monitoring – to watch, check or observe for a special purpose and note changes

Nestling – a bird too young to leave its nest

Neotropical Migrant – a species that spends its winters in warmer areas usually in South or Central America and migrates back to North America to breed

Parallels – one of the imaginary circles on the surface of the earth paralleling the equator and marking the latitude and the corresponding line on the map or globe

Primary habitat – the preferred area or place where a plant or animal lives or grows. For ***WildlifeMapping*** purposes an area the size of a football field or larger

Raptor – a bird of prey such as an eagle, hawk or owl

Secondary habitat – an area where an animal or plant will grow, but not the preferred site. For ***WildlifeMapping*** purposes an area within a primary habitat that is distinct such as a wetland

Site – the locational area of space to be monitored

Species – the basic unit of classification, consisting of populations of closely related and similar organisms

Subspecies – geographic races of the same species; or populations that occupy a discrete portion of the species' range and are identifiable from other populations by several characteristics

Threatened – official status of the U.S. Fish and Wildlife Service and the Virginia Department of Game and Inland Fisheries that places a species in a particular category of being rare. A species that is still abundant in its natural range but declining in numbers and is likely to become endangered in the foreseeable future.

Topographic map (also known as a topo map) – a geographic representation of an area on a map using contour lines and symbols to represent features.

Appendix II: ***WildlifeMapping*** Reference List

General References

Duda, M.D. 1994. Virginia wildlife viewing guide. Falcon Press Publishing Co., Helena, MT. 95pp.

Terwilliger, K., coord. 1991. Virginia's endangered species: proceedings of a symposium. McDonald and Woodward Publishing Co., Blacksburg, VA. 659pp.

Terwilliger, K., and J. Tate. 1994. A guide to endangered and threatened species in Virginia. McDonald and Woodward Publishing Co., Blacksburg, VA. 220pp.

White, C.P. 1989. Chesapeake Bay: nature of the estuary, a field guide. Tidewater Publishers, Centreville, MD. 212pp.

White, C.P. 1982. Endangered and threatened wildlife of the Chesapeake Bay region. Tidewater Publishers, Centreville, MD. 147pp.

Birds (use in conjunction with field guide with drawings/pictures)

Augusta Bird Club. 1994. Birds of Augusta County, Virginia. Augusta Bird Club, Staunton, VA.

Feduccia, Alan. 1989. Birds of Colonial Williamsburg: a Historical Portfolio. Colonial Williamsburg Foundation Publ., Williamsburg, VA.

Hansrote, Charles J., Jr. 1987. The Birds of Lynchburg, Virginia, and Vicinity. Lynchburg Bird Club, Lynchburg, VA.

Johnston, D. W. 1997. A Birder's Guide to Virginia. American Birding Association, Inc., Colorado Spings, CO. 280pp.

Kain, T., ed. 1987. Virginia's birdlife: an annotated checklist. Virginia Avifauna No. 3. Virginia Society of Ornithology, Inc. 127pp.

Kinzie, B.L. 1985. Birds of the Roanoke Valley: an annotated checklist. Barry L. Kinzie, Troutville, VA. 76pp.

Kress Ph.D., S. W. 2000. National Audubon Society birders handbook. Dorling Kindersley Limited, London. 163pp.

Larner, Y.R., and J.F. Mehner. 1988. Birds of Augusta County Virginia. Augusta Bird Club. 68pp.

Meanley, Brooke. 1981. Birdlife at Chincoteague and the Virginia Barrier Islands. Tidewater Publishers, Centreville, MD.

Meanley, Brooke. 1975. Birds and Marshes of the Chesapeake Bay Country. Tidewater Publishers, Cambridge, MD.

Simpson, Marcus B., Jr. 1992. Birds of the Blue Ridge Mountains. University of North Carolina Press, Chapel Hill, NC.

Amphibians and Reptiles

Linzey, D.W., and M.J. Clifford. 1981. Snakes of Virginia. University Press of Virginia, Charlottesville, VA. 159pp.

Martof, B.S., W.M. Palmer, J.R. Bailey, and J.R. Harrison, III. 1980. Amphibians and reptiles of the Carolinas and Virginia. University of North Carolina Press, Chapel Hill, NC. 264pp.

Mitchell, J.C. 1994. The reptiles of Virginia. Smithsonian Institution Press, Washington, DC. 352pp.

Mitchell, J.C., and J.M. Anderson. 1994. Amphibians and reptiles of Assateague and Chincoteague Islands. Virginia Museum of Natural History Special Publication No. 2. Virginia Museum of Natural History, Martinsville, VA. 120pp.

Mitchell, J.C. and K.K. Reay. 1999. Atlas of Amphibians and Reptiles in Virginia. Virginia Department of Game and Inland Fisheries, Richmond, VA 122 pp.

Fishes

Jenkins, R.E., and N.M. Burkhead. 1993. Freshwater fishes of Virginia. American Fisheries Society, Bethesda, MD. 1079pp.

Rohde, F.C., R.G. Ardnt, D.G. Lindquist, and J.F. Parnell. 1994. Freshwater fishes of the Carolinas, Virginia, Maryland, and Delaware. University of North Carolina Press, Chapel Hill, NC. 222pp.

Mammals

Harvey, M. J. 1992. Bats of the eastern United States. U.S. Fish and Wildlife Service

Linzey, D.W. 1998. The Mammals of Virginia. The McDonald and Woodward Publishing Company, Blacksburg, VA 459 pp.

Webster, W.D., J.F. Parnell, and W.C. Biggs, Jr. 1985. Mammals of the Carolinas, Virginia, and Maryland. University of North Carolina Press, Chapel Hill, NC. 255pp.

Butterflies/Moths/Caterpillars

Covell, C.V., Jr. 1984. A field guide to moths: eastern North America. Peterson Field Guide Series. Houghton Mifflin Co., New York. 496pp.

Opler, P.A., and V. Malikul. 1992. A field guide to eastern butterflies. Peterson Field Guide Series. Houghton Mifflin Co., New York. 396pp.

Wagner, D.L., et al. 1997. Caterpillars of Eastern Forests, USDA, U.S. Forest Service special publication FHTET-96-34, Forest Health Technology Enterprise Team, Morgantown, WV, 113 pp.